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A Record of the Progress of Pharmacy and the Allied Sciences

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CONTENTS

Editorial:
The "Good" Old Days 1

Selected Editorial:
The Health Angle in Advertising. Reprinted from *Journal of the American Medical Association* 2

Original Articles:
Browsings in Books Both Old and New. (Illustrated.) By Charles H. LaWall, Philadelphia 4

The Realm of the x-Ray. (Illustrated.) By Ivor Griffith, Philadelphia 9

Scientific and Technical Abstracts 44

Medical and Pharmaceutical Notes 47

News Items and Personal Notes 53

Book Reviews 57

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THE AMERICAN
JOURNAL OF PHARMACY

VOL. 100 JANUARY, 1928 NO. 1

EDITORIAL

THE "GOOD" OLD DAYS

THE "GOOD OLD DAYS" are gone—and, all in all, we should be duly thankful. Of course, there was *good*—much *good* in the good old days—but a great deal of badness also. Such badness it was, that the present age, in spite of its blatancy and drossness, would hardly tolerate long. Fortunately, it is quite common for "the special evils of an age to perish with the age."

That is evolution.

For these evils are peculiar to their times simply because the times knew no better than to tolerate them.

But as ideals are born and put to work—whether through the medium of education or of legislation, the certain bad practices, which ignorance permitted, soon sneak away and languish.

Contrast, for instance, conditions before the passage and enforcement of the Food and Drugs Act—and the Narcotic Law—with the changed aspects of today, in these respective fields. How much better things are than in the good old days—when food was often a fraud and drugs were dregs.

How happy were charlatans—and quacks—in the medicine line—when their written claims knew no censor. How readily their lung-lost victims hearkened to their vicious promises—of health in every vial.

How readily weaklings were seduced to the grip of vile narcotics—parading as limpid lullabies—indeed they were the *good* old days in many ways—*good* for nothing.

What motivated the writing of the foregoing paragraph follows:

We met with it in a little pamphlet sent us by a reader—and what a delightful reminiscence it provides—of the halcyon days of Tono-Bungay—when hokum grew unrestrained.

Only bear in mind that it is not a museum-specimen—not a genuine antique—but a current thing—actually existing—in this enlightened day. Here it is:

> "Our remedy, *Meadow Leaf Compound,* is made up from a selection of drugs that we in our judgment consider supreme and we place *Meadow Leaf Compound* side by side with our other Davis remedies to represent our standard of merit. Some people say what's the use, nothing will ever help me, I am too far gone in disease, this is giving up the fight when victory may be just over the brink. *Miracles,*—we do not call our help by this name, yet many apparent miracles seem to be the outcome of our remedies. Why not? Miracles have happened and will happen again, once a well spring gushed from a rock in the desert; once the sea stood back while people marched over dry shod; once a pillar of fire led the way by night through the wilderness. All things are possible to the high-spirited. Washington crossed the ice-jammed river and took Trenton. Kasson and his dog, Balto, reached Nome with the precious serum. Miracles are wrought every day. Let us serve you with,
>
> MEADOW LEAF COMPOUND"

Once, a great many people could be moved to believe such bunk. *Once,* decent newspapers published this kind of hokum.

Once—in an eternity—was often enough.

IVOR GRIFFITH.

SELECTED EDITORIAL

THE HEALTH ANGLE IN ADVERTISING*

THE PHYSICIAN has become a prophet in the land, and health is the word with which one conjures. Regardless of the substance to be advertised, the agency goes forth in search of medical opinion with which to vaunt it. Not that the health angle is always unwarranted; sometimes it is obvious. But not infrequently the advertiser stretches a point because he knows the health angle is popular. A soup is sold with the claim, "There's health in every spoonful." Of certain toilet accessories it is said, "Your doctor will advise against harsh, rough papers." Certified milk is called "Health bottled in bond." Of cream cheese the advertiser asserts, "For its body-

*From the *Journal of the American Medical Association.*

building elements child specialists specify this famous dairy food." Somebody's cough drops are labeled, "The cheapest health insurance in the world." Somebody's tobacco hasn't a cough in a carload. The list of things that doctors praise include a soap: "Doctors who know more than anybody else about skins urge simple care." An ointment: "Days of pain—a dreadful scar prevented—with the dressing for burns surgeons use." A nursing bottle: "Approved by thousands of doctors." A talcum powder: "Recommended for fifty years by physicians and nurses." A disinfectant: "For years the standard with hospitals and physicians." A mouth wash: "45,512 physicians indorse it." A baking powder: "772 New York doctors declare —— baking powder is most healthful." And innumerable breakfast foods, of which the least that is said is that "Doctors praise it."

The doctor's advice has been sought, it seems, for many of the most mundane affairs of human existence. Does one wish to wash some diapers: "The Borax treatment for washing diapers is recommended by leading physicians. Your own doctor will advise it." It seems that "Great doctors say: 'To break congestion, use mustard.'" Furthermore, "Many doctors advise that Kleenex Kerchiefs be substituted for ordinary handkerchiefs when one has a cold." And so one proceeds with the body from head to foot: "Gets-It is approved by doctors as safe and gentle."

When Feasley thumbed the lexicons and brought forth "halitosis," the sale of dictionaries to advertising agencies must have grown by leaps and bounds. A yeast concern says over the drawing of a pallid, haggard citizen, "Just making the motions—a victim of cachexia (run-down condition)." An insurance company has discovered a polite word for constipation. The Listerine agency, having put over "halitosis," tries to do the same for a fancy synonym for dandruff. The orange growers are emphasizing acidosis, probably because it rhymes with halitosis. What a great field there must be in the advertising profession for any one with a new idea.

The difficulty of evaluating advertising copy in these modern times is an evidence of the changing situation. The modern agency supports by evidence the claims for the products promoted. The documentation is secured through carefully combing the scientific texts, through consultation with scientific authorities, through the use of the questionnaire—and answering questionnaires seems to be a favorite pastime of many physicians—and through the securing of actual trial of the products by tremendous numbers of physicians.

The presentation of such evidence often seems an exaggeration of conditions as they are, yet the evidence is almost invariably actual. No doubt physicians have been somewhat too ready to accept broad generalizations in the field of hygiene. They seldom require the same kind of evidence in support of a cleansing agent, a dietary product or tobacco that they would demand in support of a new remedy. Hence the promoters are easily able to secure the necessary number of medical endorsements. Fortunately the situation may take care of itself: the overdoing is certain to result in reaction. But if the great minds in the advertising agencies are wise they will begin to reconsider now. Otherwise the good is likely to be lost with the evil.

ORIGINAL ARTICLES

BROWSINGS IN BOOKS, BOTH OLD AND NEW

By Charles H. LaWall

"Always there is an agreeableness to old books. It is not merely the antiquity of them, but the delightful candor and the leisurely lilt of composition that gives them their entrancing charm. Certainly they have originality also, for they were gathered together in days when the world was fallow with the apparent, yet unexplained.

"Then mark the naïveté—and often the conceit wherewith they speak of certain matters—sometime of considerable moment but now, perhaps, of no account. Their fads and fancies and fripperies and fallacies—how well they show the changelessness of human traits. How well, too, they demonstrate the oft-returning cycles of progress—the ebb and flow of the civilizing tides—as if the passage of generations were but the swing-swang of the second's pendulum—ever swinging but ever returning back whence it came."

I LOVE BOOKS; I HAVE ALWAYS loved them. Books of high and low degree have been my intimate companions since my earliest childhood, for I cannot remember a time so early that I was not able to read. From books I have learned much. From books I have derived many hours of exquisite pleasure.

Long before I was familiar with Bacon's essay On Studies, the earlier edition of 1597, which is much more brilliant and satisfying

than the augmented essay of 1625, I had learned through my own observations and experience to read in various ways; to concentrate for profit, to scan for information, to relax and enjoy, and to browse for pleasure.

I still pursue all of these methods of reading, but browsing in a more or less desultory manner has, for me, the fascination of a habit-forming drug. One who has acquired the habit after years of exposure to the practice finds himself in possession of much useless and delightful information. The browser acquires what might be termed a mental ragbag, as someone once put it, of generous proportions and varied contents, from which may be drawn the most curious and delightful patches. These may sometime serve utilitarian and commercial purposes, but more frequently they furnish a decorative scheme for ordinary conversation or for the adornment of formal addresses or lectures.

As a genuine booklover always wants to share a good book with an appreciative friend, so a confirmed and dyed-in-the-wool browser loves to dispense the result of his browsings, hence these miscellaneous ramblings and library lucubrations will appear from time to time in the AMERICAN JOURNAL OF PHARMACY, according to the pleasure of the editor and the convenience of the writer.

By-products are interesting things, as a rule. Sometimes they are unexpectedly valuable, as Columbus' discovery of America while searching for India, or the discovery of the Rosetta Stone during Napoleon's Egyptian campaign. One of the by-products of Pharmacy Week was a delightful bit of writing that appeared in a recent literary magazine. Here it is:

> "I am a visionary, of course. I am a fantastic. Nevertheless I have thus worked myself out of depression under the rain. I shall not often bore you with such windy ejaculations. Rather let us consider a minor marvel with which I met the other evening. It was a drugstore on lower Sixth Avenue, a drugstore of ancient merit. In the luminousness of one of its plate glass show windows certain herbs were outspread near the glass to celebrate I do not remember what anniversary of its establishment. And over these the phantom of that long-demised drug-clerk, the young John Keats, hovered. For I swear to you that there were actual samples of frankincense and myrrh, in pinches of powder and so labelled, amid traditional glass vessels of pleasing contour. A day or so later I noted that the exhibit had been removed. But for a brief in-

terval that drugstore had assumed the glamorous mantle of romance. Ponder on this, on the inherent romance of drugstores, when you enter one again. Search your Kipling again for the story, 'Wireless,' and ferret out a poem by Eunice Tietjens entitled 'The Drug Clerk' in one of her volumes. Purchases in a drugstore constitute one of the most ordinary incidents in commonplace life. But consider the caduceus of the god Hermes! The winged talaria flicker through the aisles of the ancient domain of apothecaries. A sorcery rises redolent from behind glass barriers where subtle potions are concocted and magic essences distilled. Drug-clerks should wear black robes endorsed with crimson cabalistic symbols. They should wave wands. They are the modern magicians. They hold in their hands the secrets of life, death, and dream. They dispense illusion. Yet they seem but humdrum ordinary men. They refuse their insignia."

This was written by Mr. William Rose Benet, the distinguished author and present associate editor of the *Saturday Review of Literature*. Now isn't that a delightful bit of prose, and isn't it all true?

And now for something else. There are bibliophiles who specialize in first editions. Their shelves are filled with books which are priceless for their rarity alone and whose spotless covers and uncut pages attest their chaste worthiness. These books must be handled with such care and reverence that an ordinary mortal fears even to touch one for fear of depreciating its value. There is another kind of bibliophile, however, who treasures books for their associations either tangible or intangible. It makes no difference to them whether a book be a first edition or not. Who wrote it? Who owned it? When was it published? Where was it published? It may be brown with age. Its covers may be broken and its leaves water-stained, but there is something about it that makes up for all these defects.

I have an interesting book before me as I write. Its leather cover is scarred and battered, its pages are discolored from age and exposure. The date of its publication is 1679. Its title is *Quercetanus Redivivus; hoc est Ars Medica Dogmatico-Hermetica ex Quercetani Scriptis Digesta; opera Joannis Schröderi M. D. Frankfurti. Sumpt. Haered Joannis Beyeri, 1679.*

"Here's richness," as Squeers would say—a work of Quercetanus compiled and augmented by the celebrated Johann Schroeder. Both of these men, although educated as physicians, were noted

Newton's Book Plate

pharmaceutical authorities. Quercetanus is the *nom de plume* of Joseph du Chesne, physician to King Henry IV in France at the close of the sixteenth century. Johann Christian Schroeder was born in Germany in 1600 and after studying in Germany and Italy became state physician in Frankfort. One of his works went through five editions in his life time and an equal number after his death, which occurred in 1664. This work is the second edition, and appeared thirteen years after Schroeder's death, a tribute of esteem for his writings which is rarely paralleled in modern times.

The illustrated frontispiece of this book is both symbolic and informative. On the left is a statue of the venerable Hermes, with scroll in one hand and globe in the other; on the right is the dignified Galen with book in left hand and uroscope flask in his right. Above, to the left, is a physician visiting a patient, to the right is a patient consulting a physician in his office. In the top centre is a symbolic arrangement of geometric figures, clouds, angels, etc. In the lower left is a representation of a kitchen symbolizing diet, in the lower centre is a pharmacy, and in the lower left, a surgery.

The book includes three volumes in the one binding, aggregating 1400 pages, with a copious index. The second volume comprises dietetics, pharmacy, and surgery. The recipes are preceded by the ℞ which about this time commenced to replace the 2ɬ which was used in some of Schroeder's earlier works. Many authorities are referred to in the text and in the formulas. "What is there of particular interest in all this?" I can hear somebody say. Just this. This book was once owned and doubtless used by Sir Isaac Newton, the famous English philosopher and scientist. It bears on its inner cover the famous "Philosophemur" bookplate of Newton, of which an illustration accompanies this note. The design of this bookplate is symbolic in the highest degree.

This book was published when Newton was but thirty-seven years of age, about ten years before he had published his famous work on gravitation called *Principia,* and about the time when he and Robert Boyle were experimenting along chemical and physical lines. Newton died in 1727, nearly fifty years after the publication of this work. How long he had it in his library or what use he made of it no one can know, but it adds interest to a book to know that one of the world's greatest scientists once owned it and doubtless handled it many times.

THE REALM OF THE x-RAY*

By Ivor Griffith, P. D., Ph. M.

Assistant Professor of Pharmacy, Philadelphia College of Pharmacy and Science

MANY YEARS AGO—a very gullible little fellow sat on a high-backed wooden bench somewhat acutely angled, in a far-away country church, and actually listened to the preacher. No longer had the odds and ends of tin boxes and buttons and dried wild plums which he generally freighted to church to while the hours away—no longer had these things any charm for him—for the preacher had captured his eye and his attention, too. Nor was that to be wondered at, for the pious old gentleman had come that morning with a burning, vitriolic message. Some village Hampden—wide-awake in sin, had brought disgrace to the little hillside hamlet, through stealing a sheep from another's fold—and the time was yellow-ripe for a red-hot sermon on sin and Satan.

Ivor Griffith, P. D., Ph. M.

And the very gullible little fellow for the nonce was all ears. He could hardly keep from applauding. Here was volcanic ash and streaming, fuming lava—sulphur—sulphur burning bright—all hell revealed as he had never heard it revealed before. Not Dante's Inferno nor any other blistering book of adventure in Satan's empyreumatic realm could have been more thrilling and realistic than this eloquent minister's presentation of a militant gospel.

Yet, even then, the very gullible little fellow wondered how it came that such a pious preacher had so much first-hand information about that mysterious scorching kingdom, whence according to Shakespeare and Omar and everybody else "no traveller ever returneth." Perhaps he was simply repeating something that somebody else had said or had written about in books.

*One of a Series of Popular Scientific Lectures given at the Philadelphia College of Pharmacy and Science, 1927-1928 Season.

And somehow or another, all of this came back to the very gullible little lad, now grown tall, when he sat down to the work of telling something about the Realm of the x-Ray. Perhaps it came back to him because he felt himself in much the same predicament as the old saint did with his Hell. For he, too, had nothing original to tell—only a repetition of something that somebody else had said or had written about in books, yet he hopes for a bit of the old preacher's mantle of eloquence and sincerity and ability to make his message intelligible.

Still it is not for my listeners to think that the Realm of the x-Ray bears too close a comparison with the fantastic realm into whose fierce fires that preacher would cast all stealers of sheep and similar atrocious criminals.

No indeed—for the Realm of the x-Ray is real—very real. True there are some very hypothetical departments to it—much territory that is unexplored—but enough of its domain has been studied and charted to impress us with its wealth of wonders.

And so we leave the old preacher and the burning question—yet wondering in passing if hell were still the fashion—and sheep stealers continued to atone for their sins in baths of burning brimstone would a thermite dip or eternity spent in an electric furnace suffice such criminals as this generation pets and pampers?

To the eternal credit of the old-fashioned hell, it can be happily said that it brooked no board of alienists; it had no mixed juries, and lawyers who dabbled in evolution had no chance in the world to cheat it of its victims. It was a good old Hell and we miss it.

I warn those who would go with me into the land of the x-Ray that it takes more than our customary sense to appreciate the joys of that kingdom. For it is a land of low visibility—and the organs wherewith we see—are not yet evolved sufficiently to appreciate unaided, the things that are in this realm of x-Ray.

Perhaps it is not in the design of things for our several senses to become any more evolved than they are in most of us, pattern-made mollycoddles. I say "most of us" advisedly, for to a few it is given to have some special sense so highly developed as to set that individual quite apart from the average run of humans.

BEYOND THE NORMAL SENSE RANGE

The cubist and the futuristic in the field of picturization can see things—and interpret things in such a way that only confounds the ordinary mortal. What normal being has visited an exhibition of such kind without having been made happy with normalcy. When an artist's sense of sight becomes so enamored of angles that curves hide with sudden shame—it is no wonder that his delineation of "A Street Scene in Simla"—looks to normal beings like a score of clothespegs dancing on a corrugated wash board.

Yet it is a natural broadening of this same sense of vision and a kindred acuity of form and of color interpretation that makes a Turner or a Michaelangelo. Yes, and this gift, too, makes a balanced interior decorator or a good dresser or designer.

Fortunate, though, is it not, that most of us, though lacking this gift of interpreting the things that are eye-pleasing and beautiful, yet possess the redeeming quality of appreciating beauty of form—of color harmony and of restfulness—which the gift of some artist depicts.

Then consider the range of our auditory equipment. Our cranial receiving sets can not tune in beyond certain high notes and below certain low ones, exactly as with our ordinary radio sets we cannot accommodate beyond and below certain wave lengths.

Yet in this field are again the few who are abnormally talented in their range of sound appreciation, and in their ability to compound these sounds into song or prose or poetry exactly as the artist weaves his canvas out of colors, and the sculptor his statue from clod of mud or marble.

I mentioned while dealing with sight sense, a spirit of thanksgiving for normalcy—yet I have, at times, envied the cubist his angular complex—and the colorist his sense of splash.

HEARING STRANGE VOICES

But with the sense of sound, too, while thankful for the God-given limits of tonal appreciation—I have often envied those who like the Maid of Rouen had the capacity to hear strange voices and to be moved by them—sweet Joan of France who—

> "Heard a voice that no one else could hear
> E'en tho the hillsides echoed, loud and clear."

And the bells of London Town that clanged only for Dick Whittington.

But when I recall that a guilty conscience can also spread the hearing and other sensibilities—as it did with persons of fancy, such as Lady Macbeth and the Abbot of Aberbrothoc with the bells on the Inchcape Rock, and with persons of fact such as Cain and Judas, my coefficient of thankfulness for normalcy again increases.

It is indeed an all-merciful Being that handles our dust, our doings and our destinies. Meticulously has the sound recording device in us been so arranged and developed that it registers only that span of tones acceptable to the organization that encompasses it. Had our ears been made sensitive to the noise of molecules—a day in a forest hearkening to atoms agog in growing trees would set us crazy for the rest of our lives.

THE NOISE OF MOLECULES

Listen to what Huxley, in speaking of the stirring activities going on in plant cells, says: "The wonderful noon day silence of a tropical forest is, after all, due only to the dullness of our hearing; and could our ears catch the murmur of these tiny maelstroms, as they whirl in the innumerable myriads of living cells which constitute each tree, we should be stunned, as with the roar of a big city." And whoever has heard the radio receiving set, after it catches the infinitely small electric impulses and whips them up into sounds that fill a large hall can appreciate the fullness of his statement. For sounds more silent than the farewells of ghosts can be amplified so with this new mechanism that the human ear is paralyzed with their turmoil.

But there are queer artists in tonal effects exactly as there are queer artists of form and color. For in the realm of sound interpretation too, you will find the "musical" (?) cubists and futurists —who only see the odd angles of music and fail to get the curves and concord of sweet sounds.

THE NEW PURGATORY

Earlier I refer to a pleasant brimstone purgatory. Much more modernistic and punishing would be a hell where sinners would be forced for ever and a day to look at cubist paintings and sculpture—to listen eternally to a horn with a dizzy diaphragm recording amplified jazz—nonsense set to music.

The diet would be the general run of American breakfast foods full of eternity-insuring vitamins—with bootleg rum to wash the roughage down. Then to add to the hellishness of it all the everlasting sufferers are forced to read and re-read Elmer Gantry and Clarence Darrow's Defense of Loeb and Evolution.

That would be Hell.

Nor are these two senses alone in their limitations, for happily the rest of our senses are likewise governed. There are odors and flavors—and touch vibrations too fine or too coarse for our limited senses to appreciate. Thank goodness for a dignified normalcy in these directions, too.

Hearken to what Dr. Mackenzie of the medical faculty of Edinburgh has to say about our sense of smell as interpreted by Henry Tetlow, a *Ledger* columnist. He insists that the olfactory equipment of man is scarcely better than that of the amoeba. As a matter of fact I doubt that it is as highly organized as is the predatory smell sense of as low a creature as the pseudopodic vampyrell, which can apparently distinguish its special diet of algeal spirogyra by smelling it a hundred bacterial miles away.

"If in comparison with Fido, our sense of smell were as highly developed as our vision, we would in truth be sitting on top of the world. We could smell around corners. We should not have to resort to guessing at the strength of an opponent's hand.

CONSIDER THE EARS OF BUTTERFLIES

Nor is it nearly as ridiculous as it sounds. Look what the butterflies can do! You can insulate certain of them—polyphemus moth is one, and the commonest one hereabouts—with steel, glass or what you will, and its mate can smell it out. A fact which has led scientists to the interesting conclusion that whereas most odors travel by emanation, by waves of the odorous principle itself, others are transmitted in the same way that sound waves travel. Man is, presumably, insensible to these latter, just as he is to the direct contact of the sounds which are caught up in his radio and reduced to intelligible terms."

Possibly, some day, an inventor will produce a broadcasting set which will do for our sense of smell what the radio has done for our feeble sense of hearing. Think what a weapon of offense a pound of Limburger cheese might be with its emanations amplified a million fold!

But the sense of smell is in a category quite distinct from those of sight and sound, for the images it presents to the human brain are, in spite of their dual nature quite fugitive. The most that a whiff of a smell can do with us is to remind us of the last time we smelled it.

So we may register our thanks for a fundamental limitation to our sense of smell and for the fact that there is no special incentive to develop its acuity. In other words the nose knows enough.

Except again that we may be glad that to an elect few is given the ten talents in taste and smell—for out of this group we draw our perfumers and chefs and compounders of sauces and curries and cocktails.

But to come to light and the x-Ray. The nature of light has puzzled mankind throughout history—and in many respects continues to puzzle today. Early thinking man accepted it with about the same degree of inquisitiveness as the oyster accepts the ocean. You recall that early man was this way about many things. For instance, his elaborate scheme of analysis particulated matter into only four parts—a little more generous than Caesar was with Gaul. This quartette was composed of air—earth—fire—and water, and there was a fifth ghost-like member, the quintessence, which sort of inspired and directed the aforementioned quartette.

Modern chemists have gone a great step further and matter is now elementally divided into ninety-two primitives—and some thirty thousand odd combinations of these elements are known to exist—with a million others in the offing.

The ultra-modern chemist, however, goes further yet, but returns to the simplicity, though perhaps not to the ignorance, of the ancients by affirming that matter, after all, is not composed of a choir of ninety-two—nor of the antiquated quartette—but is one grand continuous solo—with hydrogen as the single performer.

THE GREEKS WERE GREAT GUESSERS

The Greeks insisted, on a purely intuitive or hypothetical basis, that light was a corpuscular form of matter whch came from the sun and its stellar servants. And the Greeks were great guessers—and unlike the modern great guessers—the Weather Bureau for instance—quite often the guesses of the Greeks grew up to be real discoveries. Diogenes, the Greek sage in a tub, must have known, centuries before our

heliotherapists, what value was in sunlight. For did he not, when visited by Alexander the Great, tell that gentleman, who would bestow a favor on him, that the greatest favor he could possibly grant, was to "get out of his light."

You may search in many of the modern concepts—notably in the world of physics and chemistry—and you will find in the Greek period the nuclei wherefrom this current wisdom sprang.

Over 3000 years ago, Thales, the original absent-minded professor, not of Greek but of philosophy, guessed that there was a oneness to matter—and an indestructibility that was absolute. His lodge-brother, Anaximander, agreed with him—and conceived the existence of a fundamental unit, which he termed the *"apeiron"* and which he supposed to be "eternal in character and unlimited in extension."

Democritus, the philosopher who laughed some at his own, and a lot at others' philosophies, rechristened this primal unit of Anaximander, and called it the *atom*. The atom is still a useful term, even though the modern physicist has smashed it to pretty bits, and the Greek guess which pronounced the corpuscularity of light is returning to physical favor.

But it is a long time from the hey-day of Greece to the day when man returned to his philosophies. The civilizations that followed the athanasia of Athens were too busily engaged with greedy creeds to worry much about atoms and light. Hence the "Dark Ages."

Centuries afterward, just about the time that William Penn, "Proprietor of Pennsylvania," was drawing plans for a city of brotherly love, on the banks of his favorite fishing creek, the Delaware, a busy Englishman, Isaac Newton, discovered that light was not an elemental substance, but a composite thing capable of being divided into its component parts.

SIR ISAAC NEWTON SEES THE LIGHT

This is the same Isaac Newton whose name is familiar to every schoolboy as the apple-inspired philosopher. I do not know whether the apple, which obeyed an impulse to drop on Sir Isaac's bald spot gave him, in addition to the gravitation clue, some suggestion of the complexity of light—I would have been certain of the dual discovery had the apple been a cocoanut.

His discovery was made through the use of a glass prism, much like the kind of a glass prism which children, in hanging lamp days, were wont to peer through to get an Easter egg effect out of everything looked at.

Newton made his experiment, however, in a dark room, permitting a beam of sunlight to pass through a hole which, during Mrs. Newton's absence, he had clandestinely bored in their pale green shutter. When he passed this beam through a glass prism he found that it was broken up into a regular range of colors and that the beam was bent from its course, violet bending the most, red the least. These colors where previously known, of course, and some had names—but it had never been known what relation colors bore to light. The conventional order in which these colors appeared in Newton's and in every similar experiment is given as violet, indigo, blue, green, yellow, orange, red.

GHOST COLORS

To this play of colors Newton gave the name "spectrum" in deference to its ghostliness, although variegated ghosts are not particularly common. Still the color effects of the spectrum are about as valuable as a ghost, and as unnatural as a shadow, for the artist cannot dip his brush in them and transfer them to his canvas. Truly they are spectral hues.

Of course, it must not be construed that Newton was the sole latter-day pioneer in the study of light, for certain phenomena and laws of light had been well known some years before his time, Snell in 1621 and Descartes, a little later, had worked out and published their studies on light refraction—but they had no idea, in spite of rainbows, that, light, like Joseph's coat, is a mixture of many colors.

Newton, scientist that he was, did not stop with this one experiment, in spite of the fact that he was busy mapping the solar system, explaining the tides, building the first reflecting telescope and suggesting problems for future crops of philosophers to puzzle over.

Not satisfied to tear light into its colored fractions he attempted further to subdivide these colors. For instance, he passed portions of the spectrum, found by the first prism, through another prism, but try as he would he could not make the green give other than green, nor red other than red.

Furthermore, not convinced by analysis alone, he turned to

synthesis and proved that the colors of the spectrum could be reccombined to form white light.

"Nature and Nature's laws lay hid in night, God said: 'Let Newton be' and all was light." That is how Pope epitomized the doings of the great author of "Principia," that work of Newton, which Halley, too, eulogized "So near the gods, man cannot nearer go."

THE CHANGELESS SKY-HIGH SPECTRUM

For centuries the greatest spectrum of all, the rainbow, had been accepted, through the belief of ancient Hebrews, merely as a symbol of God's bow, forever hung high on clouds, an earnest of His promise, never again to punish with flood and hurricane His sinning Israelites. Indeed Jehovah himself is quoted as having said: "And it shall come to pass, when I bring a cloud over the earth that the bow shall be seen in the cloud, and I will remember my Covenant which is between me and you and every living creature of all flesh, and the waters shall no more become a flood to destroy all flesh."

Recent experiences in Vermont and with the Mississippi rather prove the local fallibility of rainbows.

And so even Newton himself overlooked the greatest spectrum of all and turned to pigmy rainbow effects plastered on his kitchen wall. What Newton discovered after all was only the visible spectrum, in other words, only such colors as the human eye is organized to pass into consciousness for those who possess the faculty of sight.

But after Newton came others who amplified and developed his studies in several directions, for the discovery of the spectrum was only an invitation to further exploration. Light since then has taken on a great significance—and the end of the road is still far off. Today more than ever, are we aware of the close contacts between life and light and it is not unwise to prophesy that we are on the borderline of tremendous discoveries in this field.

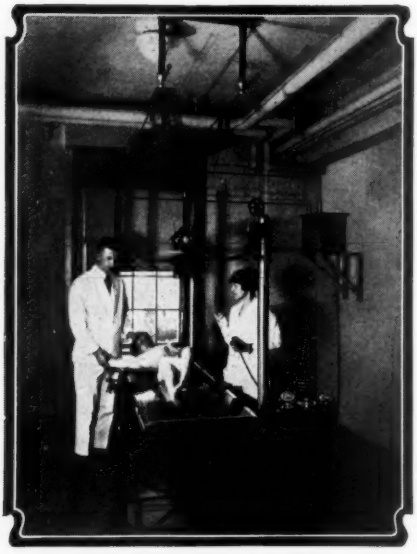
Since Newton's day science has demonstrated conclusively that light is infinitely more than ever Newton conceived it to be. That great man and many who followed him were much handicapped by a meager supply of instruments and power wherewith to augment their limited sense faculties, and such handicaps are more than ever appreciated when we tell you that the greatest effects of light

after all are such as cannot be studied with eye unaided nor separated without strenuous methods and concentration.

Listen to this quotation from one of Dean LaWall's former lectures and understand what a tremendous advantage modern physicists have over such as Newton and Tollaston and other early workers in the realm of light.

TOOLS OF MODERN PHYSICS

"Testing machines have been perfected with a compressing force of millions of pounds per square foot and yet so delicate in their adjustment that the slight pressure necessary to crack an egg shell can be measured by



The x-Ray Laboratory

the same machine. Measuring devices are available for accurately determining the velocity of light in spite of its mania for speed. An instrument used by astronomers for measuring angular magnitude is capable of detecting an arc of one inch subtending a radius of 100 miles. Electric power has been developed so intensely that hundreds of thousands of volts can be marshalled and directed to do man's bidding. A thermometer for making temperature measurements is so refined in its adjustment that the heat from the flame of a match held many feet away can be recorded. Balances are in

use that are so sensitive as to detect the 1/30 millionth of an ounce, and when we consider the spectroscope, which is four million times as sensitive as the finest balance, and the electroscope, which is a million times more sensitive than the spectroscope, we seem to be nearing the limit of human possibilities in the direction of physical measurements. All of these instruments and others almost equally amazing have been summoned to aid in unfathoming the mysteries of physics and chemistry."

While the word light truly but describes that kind of ethereal radiation which is capable of affecting the eye, yet in a broader way there are fractions of light, below the visible red and beyond the visible violet, which are infinitely more important than such visible effects as are encompassed by the spectrum.

THE x-RAYS IN NATURE

Here dwell the infra-red rays—the radio transmission waves, the ultra-violet rays and the x-Rays—and a great many other rays.

And someone asks the question: "Are x-Rays and other like rays in Nature, outside of those generated in the laboratory." The answer, of course, is Yes!

Indeed, they play a most prominent part in Nature's activities—at present, not at all understood. Yet we do know of their busy presence in atmospheric electricity, their temporary imprisonment in the radio-active elements, and their very definite share in the light given out by sun and stars and in concurrent life processes.

Do you wonder that it took so long to find out some of these things about light when it is known now to travel over ten million miles a minute, or accurately 186,000 miles a second? At this rate it takes less than ten minutes for it to come to us from the sun, which is ninety-three million miles from the corner of Tenth and Arch Streets in Philadelphia.

Of course, there are myriads of other suns from where it might come to us. Unfortunately, they are so far away that their light takes many years to reach us.

And so we turn now, after what may have been a rather involved and long-winded introduction to the realm of the x-Ray, which is on the nether side of the visible spectrum. Some time after Newton's day Karl Wilhelm Scheele, a young apothecary, noted that there were influences beyond the visible end of the spectrum which possessed definite chemical properties. He proved this beyond doubt

by demonstrating that silver chloride could be reduced by these influences into elemental silver.

After him came Ritter and Young who early in the nineteenth century discovered the ultra-violet rays. In an article entitled "Light and Health," Dr. Mayo of Rochester, attaches a great importance to these short rays:

> "Certain wave-lengths of ultra-violet rays are most important in stimulating the chlorophyl (which is the green of plant life), the hemoglobin of blood-cells (which, in thin layers, are also green), and the photo-sensitive plate. The ultra-violet is the most stimulating and is held by the tissues of the skin while shorter and longer waves at both ends of radiant energy pass through or are absorbed by the body. Thus red glass holds back all but the red waves of the light or visible spectrum and passes a considerable quantity of heat waves. Ultra-violet causes the cells of the skin to protect their nuclei rapidly by screening with melanin, or the so-called tan of sunburn. Such rays lower blood-pressure from 7 to 10 per cent., somewhat increase the oxygen of the blood and blood calcium, the activity of endocrine glands, and the storage of iodine by the thyroid. This is of great importance as the blood carries the same fourteen primary elements that good soil does for plant life. The ultra-violet increases vitamin A; in fact can develop it in linseed oil exposed to the ray. Cod-liver oil has a large amount of this vitamin. Thus the violet ray of the sun prevents and cures rickets, which is so prevalent among the children of Scotland with its fog and the clouds and smoky air, as it is approximately only for one-half year that they have much chance with old Doctor Sunshine.
>
> "Fortunately man's ingenuity has developed the quartz glass (or fused quartz) which permits the ultra-violet ray to pass. Celluloid and paraffined gauze are also somewhat permeable to it while common window-glass cuts out most of it. Thus the mercury-vapor quartz-lamp, or arc light with carbons combined with nickel, emits a large amount of ultra-violet which can be used in the treatment of chronic diseases, especially tuberculosis of the lungs and joints. The greatest effect of ultra-violet from sunlight is obtained at midday as the rays pass through the thinnest layer of air over the earth. The long slanting rays of morning and afternoon are largely screened by the air, especially because of the average half-inch layer of water diffused in hydroscopic form throughout the air. Thus high mountain altitudes are used in order that such sun treatments shall be most effective, although ultra-violet treatments are of value for shorter periods in any place, and artificial ultra-violet light can be created where nature gives little or no aid with sunlight."

Herschel in 1800 caught the infra-red rays hiding on the other side of the spectrum. Their heat-producing qualities were definitely established through the agency of a very sensitive thermometer. He proved that, beyond the violet rays of the spectrum were the rays that manifested the least heat and that beyond the red was a zone as yet uncharted, but which carried a definite amount of energy as heat.

These rays have not been extensively studied. They pass through many substances such as glass, mica, etc., about as readily as a cootie might pass through our City Hall gates. Yet certain substances, like quinine hold them back, a fact which has been applied in making sunburn creams which are supposed to prevent the intense effects of seashore sunburn.

During the World War infra-red ray photography was largely used by aviators, by virtue of a peculiar property which they had of differentiating the natural green of foliage from the green colors of camouflaged defences. For this purpose certain filters which excluded all but the infra-red wave lengths were utilized. These rays are being intensively studied at present with a view of their therapeutic applications.

A great development in the field of light came through Roemer's appreciation of the fact that light had a finite velocity and was undulatory, that is, it travelled in the form of waves.

The various colors of the spectrum and the influences outside of the spectrum are now known to be simply radiations that differ only in their wave lengths. They do not differ in any other essential particular. Through the whole range of telegraphic waves, which may be a mile or more long to x-Rays, of which the wave length is actually smaller than the diameter of atoms, and capable of expression only in terms of billionths of an inch—they travel at precisely the same speed—the only speed at which the ether is able to transmit energy, and are all subject to the same laws of interference, of refraction, reflection, etc.

A HOMELY ANALOGY

The only difference in these several light forces is as stated previously—in the length of their waves and of course in their frequencies. A rather homely analogy to use in this connection is to borrow a leaf from Bud Fisher's book or rather his carbon mannikins, Mutt and Jeff. Mutt, you

will recall, is the narrow individual with the narrower and longer legs; Jeff being the compressed one, with short legs and an insufferable conceit. Now then, assuming that the pair harmonize long enough to cross a mile-long bridge starting together and ending together. Their traveling distance and time will have been exactly the same, and their velocities identical. But it takes no vivid imagination to know that Jeff's little legs must have vibrated and oscillated twice as fast as Mutt's long extremities.

They covered the same distance in the same time, at the same speed simply because Jeff's frequencies or knee jerks equalized Mutt's wave lengths or steps.

So it is with the rays of various kinds—their velocity is constant, the only difference comes in the wave lengths or steps, and a consequent difference in frequencies.

Pons Asinorum—Q. E. D.

For some understanding of the waves, measurements of wave length have been established. The unit of measurement has been fixed by convention (International Union of Solar Research) and is called the Angstrom (A.)

Anders Jonas Angstrom was a Swedish physicist (1814-1874). He wrote *"Reserches sur la Spectre Solaire,"* 1868. The unit there, considered, in terms of the metric system, is equivalent to a wave length of one ten millionth of a millimeter. Measured in inches, an Angstrom unit is equivalent to one two-hundred-and-fifty-four millionths of an inch.

One meter equals one thousand millimeters.
One millimeter equals one thousand microns.
One micron equals one thousand millimicrons.
One millimicron equals ten Angstrom units.

Color of light in terms of its wave lengths in Angstrom units.

Invisible:

Infra-red region Over-7700A

Visible:

Red 7700-6200A
Orange 6200-5900A
Yellow 5900-5600A
Yellow-green region 5600-5300A

Visible:

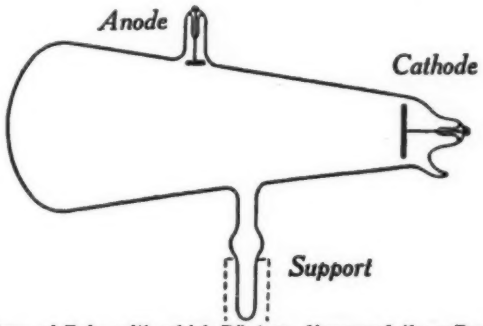
Green region	5300-5000A
Blue-green region	5000-4700A
Blue region	4700-4300A
Violet region	4300-3900A

Invisible:

Ultra violet	3900-2000A
x-Ray, etc.	Below 2000A

RÖNTGEN

In 1895 Professor Wilhelm Konrad Röntgen of Würzberg, Bavaria, discovered almost accidentally the x-Ray, as we call it here, or Röntgen ray, as Europe calls it. He was experimenting with a device known as a Crookes' tube, which grew out of a toy vacuum tube devised by



Type of Tube with which Röntgen discovered the x-Ray

Geissler of Bonn in 1857. Sir William Crookes (1832-1919) had noted that the negative pole of a vacuum tube gave off cathode rays if excited by a high frequency source of electrical current, and that the intensity of this ray production increasing as the rarefaction of air increased.

TRAILING THE x-RAY

Röntgen was indulging in the then scientific pastime of trailing rays—having wrapped up one of these vacuum tubes in some black paper, he was amazed to find that after he turned on the switch a fluorescent screen which he had casually placed on a nearby table shone out brightly. The light-tight cover precluded any possibility of the effect having been due to ordinary ultra-violet light, and Röntgen was convinced

that some strange radiation was stealing its way from the tube. When he interposed his fingers in front of the tube he saw that they cast uneven shadows on the screen and in this way he tracked back the unknown or x-Rays to their lair.

That proved to the spot where the cathode rays hit the glass wall of the tube. Further investigation proved that these rays are produced wherever cathode rays encounter matter. *Today we know that x-Rays are caused when individual electrons, travelling at a high speed in a vacuum, encounter the obstruction of a target.* The modern physicist will tell you too, how small these electrons are, by asking you to recall that an atom is the smallest particle imaginable, and then confounds you by telling that an electron bears the same relation to an atom that a fly does to a cathedral, or a flea to a Zeppelin.

But to Röntgen the fascinating feature of the new rays was their unusual ability to crash through many substances with which ordinary light had no chance of penetration. He had noted when he held his fingers in front of the fluorescent screen that his flesh being less dense than his bones, the latter stood out dark as compared with the shadow of his flesh on the screen.

He at once grasped the tremendous possibilities of his discovery and—gave it away to the world. To a little group of wide-eyed surgeons gathered at a medical meeting house in his old home town, Würzberg, Röntgen communicated his epoch-making find.

Röntgen was not a physician—nor a surgeon, yet he freely gave to that profession for humanity's sake, a marvelous diagnostic aid which has made certain aspects of surgery more certain than ever before.

How differently did the physician Ehrlich behave with his equally marvelous discovery of salvarsan, that specific remedy for the unspeakable disease. "Covered by letters patent"—that was the story of salvarsan—and Ehrlich lived long to capitalize, with his boon, the sufferings of victims of that dread malady. But Röntgen was built of better stuff.

INVENTION RARELY COMES FULL-BLOOM

It is rather unfair to give Röntgen all the credit for the discovery and practical application of the x-Ray. Indeed such invention is never a one-man job. Who has ever watched beneath the tell-tale acreage of lenses

well assembled, the growth of a perfect crystal, but cannot draw from it a parallel to the consummation of any great discovery, such as this discovery of the x-Ray? Indeed the progress of a crystal in its growth from nuclear source, out of the depths of murky fluid, is always one of slow but dead-sure progress. Tiny particles, builders of every crystal, dance about in Brownian ecstacy, and dart in all directions, searching for their nuclear leader. Finding it they come to rest beneath its ramparts. And from all directions they draw their cohorts to the coalescence, and only the proven pure can join their congregation.

Atom upon atom, particle upon particle, and sheath upon sheath, the crystal is built, gradual, orderly and certain. Finally facet, axis and edge, definite in every detail, announce with no mistake the form of a perfect crystal. And the dross, the foreign and colloid things are left behind in the fluid—only the actual, belonging things find room in the mass of the crystal. This finished crystal, so the physicist states, is now the large scale, accurate picture of each of its little atoms. Such, we say, is the tale of every invention in every field of endeavor. Invention never comes full blown, like Jove begat Minerva, but slowly like the gathering home of atoms to a naive, attractive nucleus.

And before and after Röntgen have come many, many workers who shared in bringing the x-Ray and other similar forces into their present field of usefulness.

To effect his discovery it is interesting to note that Professor Röntgent was particularly indebted to previous inventions such as:

The pear-shaped vacuum tube devised by Geissler of Bonn, and improved by Crookes and Hittdorf and others.

The air-pump, as first made by Otto Von-Guericke in 1650, for creating a vacuum.

A high tension electric current, as first produced by Faraday in 1838, to send through this vacuum.

A fluorescent screen, consisting of a deposit of barium platino-cyanide crystals on cardboard, used by physicists in previous investigations of ultra-violet light, having found that these crystals had the property of giving off visible light while in the path of an ultra-violet beam.

But beyond all, posterity owes Röntgen everlasting acclaim for the strength of mentality to convert an accident into an observation that showed the way to marvelous possibilities.

I am unable to restrain myself from quoting the result of an interview with Professor Röntgen which Sir James Mackenzie Davidson, an eminent English scientist describes.

> "I presented myself about 11 a. m., and was shown into a laboratory which contained a coil and a small cylindrical-shaped x-Ray tube. Professor Röntgen, a tall man with dark bushy hair, a long beard, and very kindly and expressive eyes, received me cordially. He could not speak much English; I was still worse at German. However, by means of English and some Latin we made ourselves intelligible to one another.
>
> "I asked some blunt questions as follows:
>
> "Q. 'What were you doing with the Hittdorf tube when you made the discovery of the x-Rays?'
>
> "A. 'I was looking for invisible rays.'
>
> "Q. 'What made you use a barium platino-cyanide screen?'
>
> "A. 'In Germany we use it to reveal the invisible rays of the spectrum and I thought it a suitable substance to use to detect any invisible rays a tube might give off.'
>
> "He then detailed how he made the discovery. He said he had covered up the Hittdorf tube with black paper so as to exclude all light, and had the screen (which was simply a piece of cardboard with some crystals of barium platino-cyanide deposited on it) lying on the table 3 or 4 metres from where the covered tube was situated, ready to be used. He excited the tube to ascertain if all light was excluded. This was so, but to his intense surprise he found the distant screen shining brightly!
>
> "I asked him, 'What did you think?' He said very simply, 'I did not think, I investigated.'
>
> "Incidentally, he told me how he had taken a photograph through a pine door which separated two of his laboratories. On developing the negative, he found a white band across it, which, he ascertained, corresponded to the beading on one of the door panels. He stripped the beading off, and found the band of shadow was due not to the increased thickness of wood but to the plumbum (white lead, really) the doormaker had employed in attaching the strip of wood.

THE HISTORIC SCREEN

> "He seemed amused at my remonstrating with him about keeping the 'screen' lying about in his laboratory. I told him it was a 'historical screen,' and should be preserved in a glass case! I hope he has carried out this suggestion. For the sudden shining of that 'screen' undoubtedly led to one of the greatest discoveries in modern times."

THE FIRST PUBLIC SHOWING OF THE x-RAY

Immediately after Röntgen's discovery, physical scientists everywhere, attacked the problem of improving and elaborating the rather crude vacuum tube used by the discoverer. The arts and the industries, too, turned to the business of applying the new agency in some practical way. The whole world was agog with x-Rayitis, and the first generators and devices were investigated with so much meticulousity, were gossiped about with so little veracity, were newspapered with so much generosity, as is comparable only to the recent success which Henry Ford displayed in steering his new Bouncing Bet right into the heart of every American establishment.

There are some here who recall vividly the curious crowds at the first display of bone-exposing x-Ray apparatus out in the Commercial Museum, where but two or three decades later it was Henry Ford's magnanimity that permitted similar crowds to gaze in rapture at his glorified bone-wrenching apparatus. *Sic transit!*

Through quick successive stages the x-Ray passed in point of evolution and development until the present armamentarium of the roentgenologist is as incomparable with Röntgen's original apparatus as one of the new electric superheterodyne radios would be with that toy of a radio compounded from oatmeal boxes, bell wire, a piece of galena crystal and the cat's moustache, which gave us the original thrill of picking music through the rain drops.

THE FIRST DEVELOPMENT: THE COOLIDGE TUBE

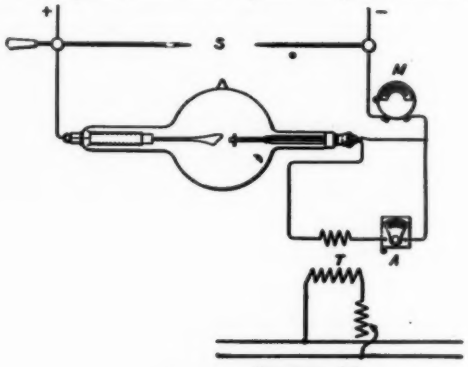
Three outstanding developments occur to us at present. They are firstly the *perfected vacuum tubes,* notably the *Coolidge tube,* which operate with more constancy than the older forms—which so commonly developed cranky streaks.

Dr. Coolidge, who is associated with the General Electric Company, devised a tube

> "where the cathode consisted of glowing tungsten and the vacuum in the tube was made as perfect as possible. Such a tube can be operated continuously and still show constant characteristics. Referring to the diagram shown herewith, the cathode of the Coolidge tube is a small spiral of tungsten wire so arranged that it can be electrically heated by a small transformer.
>
> "A rheostat allows the filament current to be regulated to give the filament temperature desired. The filament current is independent of the high voltage connections to the x-Ray transformer proper.

"When the filament is heated there is an emission of electrons which, when the high voltage current from the x-Ray machine is placed across the tube terminals, serve as a medium for carrying the x-Ray current through the tube, *i. e.*, from cathode to anode."

The speed at which these electrons travel across to the anode is determined by the amount of voltage impressed. If 60,000 volts is impressed the electrons will travel at an approximate speed of 82,000 miles per second, and the resulting tremendous impact on the tungsten target in the anode produces the still more rapid x-Rays. The penetrating power of these x-Rays corresponds to the speed of these electrons at impact, and this speed may be varied at will by the



The Coolidge Tube

amount of voltage impressed across the tube terminals. Those who are familiar with the electron theory of the modern radio tube will readily understand the principles of operation of the Coolidge tube.

THE SECOND DEVELOPMENT: ELECTRICAL DISCOVERIES

The second development was in connection with the new *electrical discoveries whereby increased voltage has been made possible.* Even the smaller x-Ray laboratories are now capable of building up voltages well over 200,000, a definite essential where deep-ray therapy is being practised.

THE THIRD DEVELOPMENT: IMPERVIOUS MEDIA

Thirdly, came the *devices whereby, for diagnostic purposes, the ray was made exceedingly more valuable.* Fleshy tissue is pervious to the ex-Ray, and in consequence internal tumors and other formations, being fleshy in nature, show little or no shadows on the plate.

For instance a growth inside the stomach could not be readily demonstrated by the x-Ray picture alone, and the only satisfaction to curiosity came by way of a good surgeon with a collection of sharp knives. But the idea struck someone that if the inside of the gastric cavity was kalsomined with some harmless material, impervious to the ray, a good outline picture could be secured. Accordingly, so was it done.

Radiograph taken with barium meal in the intestinal tract

Bismuth subnitrate,* barium sulphate and similar innocuous and ray-obstructing chemicals are poured down the gastronomic chute of the candidate, who is in due time placed on the grill and pictured. Deformities in internal organ outlines are clearly delineated in this way—and the procedure has been of intense value as an aid to diagnosis.

*Hereabouts the late Martin Wilbert, Apothecary to the German (Lankenau) Hospital, is credited with introducing such compounds to x-Ray practice.

The idea of Ehrlich's selective affinities has also been used in this way, and the gall gladder and duct, heretofore shy to the photographer are made bold in outline by pouring into the system a chemical which travels through the body until it finds its friend the gall bladder, with which it stays long enough to make it impervious to x-Ray and to cast its shadow on the plate.

Nowadays the surgeon does not have to take the gall bladder out on general principles or for lack of them—he x-Ray-inquires first, and having found through that medium that the bitter bladder is pathologic, he then proceeds to sharpen his knives and rip saws.

So that at least a part of this presentation will have a semblance of regularity I choose to run in at this point an orderly, summarized presentation of the uses of the x-Ray in its several fields.

IN MEDICINE

It is not difficult to conceive what consternation would reign in medical ranks should the physician and dentist and surgeon be suddenly deprived of the use of the x-Ray. There is practically no region of the body that is not subject to a searching examination for the detection of disease or injury at some time or another. Many cases where the treatment of some conditions would have proved complicated and the outcome very much in doubt, had not x-Ray been available, are now easy to diagnose and sometimes to treat.

One of the very common uses of the x-Ray in the hands of the physician and surgeon is in diagnosis and treatment of fracture cases. When a broken bone is suspected, off goes the patient to the invisible ray artist, who exercises his judgment in the kind of a ray intensity needed to depict the particular bone whose fracture is suspected. This simple picture-taking operation is not unlike an ordinary portrait taking, except that one need not look particularly pretty nor feel correspondingly uncomfortable with it.

Anyone at all familiar with ordinary camera photography will readily understand this step in the procedure. The photographic film, in a suitable light-tight holder, is placed under the injured part of the patient, while the x-Ray tube is focussed above. The x-Rays emanating from the tube penetrate the part of the body under observation, and finally reach the emulsion of the film, recording the shadows and various densities much the same as ordinary light acts on the film in a camera.

With the radiograph before him, showing the exact nature of the fracture, the physician can now intelligently and effectively set the fracture. After placing the limb in a cast he again resorts to the x-Ray as a means of checking up, to determine whether correct setting of the fracture has been accomplished. The result is that in the treatment of most fractures in present-day practice, the x-Ray

Where every head is a bone-head

insures more or less against impaired functions of the injured parts, such as our fathers so often suffered simply because there was nothing wherewith to check up the "bonesetter."

THE INQUISITIVE RAY

Fluoroscopy is another form of diagnosis with x-Rays. This involves the use of a fluorescent screen, consisting of a cardboard surface treated with chemicals which fluoresce, *i. e.*, give off visible light, when exposed to the action of the rays. With the patient placed between the tube and the fluorescent screen, the rays pass through the body and

act upon the chemicals on the screen, causing them to cast ominous shadows on the screen.

In this way it is possible to interpret heart action, and lung structure, to study the track of food through the stomach and through the convolutions of the intestine, and so to gain intimate knowledge of digestive functioning.

Through the use of opaque materials it is possible to study the structure of the kidneys and ureters. Many other abnormalities such as tuberculosis, cancer, and the various tumors, including carcinoma of the breast can be revealed with the x-Ray.

A few reproductions of Dental Radiographs. Courtesy of Dr. C. O. Simpson, St. Louis.

(Read left to right)

1. The development of the permanent teeth to replace the baby teeth.

2. The abnormal development of a tooth bud which has prevented the eruption of a normal tooth.

3. An impacted third molar which has destroyed the root of the second molar. Also an abscessed first molar under a crown.

4. Extensive destruction of the bone from a tooth without metallic fillings.

5. A cyst which has destroyed the bone around a tooth and the outer plate of the jaw.

6. Advanced destruction of the bone around the teeth from pyorrhœa alveolaris.

Even the appendix can be routed out of its hiding place by this inquisitive ray—that is, providing the surgeon has not been there first.

The same means are used by the physician to locate or detect foreign bodies. Most everyone has seen at some time or other, x-Ray reproductions showing pins, safetypins, nails, coins, buttons, hair pins, pipe stems, tooth plates and other spare parts lodged in the trachea or in parts of the alimentary tract. These foreign bodies which are accidentally swallowed, cause a great deal of alarm. With

Radiograph of an Egyptian child mummy in a wooden casket. (This child lived about 3000 years ago.)

the x-Ray, however, the surgeon learns whether an immediate operation is necessary. If not, he can watch the progress of the foreign body from hour to hour, sometimes from day to day, and in a great number of these cases sees the final expulsion of the article without surgical intervention.

For even a surgeon is glad, on occasion, to avoid an unnecessary carving.

In dentistry it is invaluable in charting the hidden geography of our jaws and sullen, silent abscesses are demonstrated through means of the x-Ray. The universal pastime of tracking a focal infection to its hiding place in tonsil or toenail or tooth has found the x-Ray a most invaluable pus-hound.

Deep ray therapy is a fairly new development of x-Ray application. This form of treatment began a few years ago in handling certain forms of skin diseases with marked success. This was only superficial x-Ray therapy.

Since the advent of the 200,000+-volt Coolidge tube in 1921, however, interest in the treatment of deep-seated malignant diseases with x-Rays has been greatly stimulated, and while specialists prefer to wait over a period of years before stating definitely the degree of success realized, they are much encouraged with the results attained thus far in the treatment of cancer, that much-dreaded disease so widely prevalent today, and which has baffled medical scientists for ages.

The old concept of curing like with like may be playing its silent game in this connection, too, for cancer is considered by some to be a disease due to a vitamin deficiency or excess. And since vitamines are stated to be "Compressed light" the use of ray agencies, such as radium emanations and deep x-Ray in the treatment of this alleged vitamin disease, is quite in line with the Hahnemannian concept.

THE x-RAY IN INDUSTRY

Röntgen and others foresaw the value of the x-Ray in industry especially insofar as the study of metal structures is concerned. Yet the ray, here, too, was not of much value until the development of the higher power Coolidge tube, capable of handling 200,000 + volts. As pointed out elsewhere the more dense the material, *i. e.*, as the atomic weight increases, the more powerful must the x-Ray be to penetrate it. And as the voltage is increased in the x-Ray tube, the resulting radiation is increased in its power to penetrate a given substance.

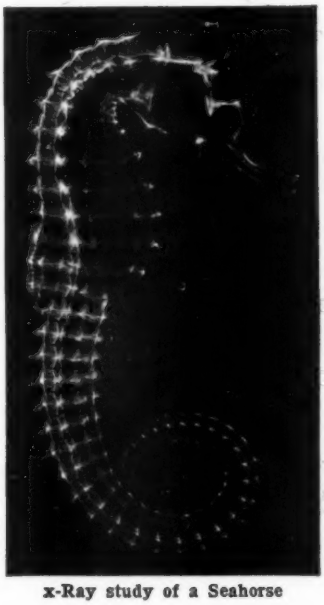
Dr. H. H. Lester, Research Physicist, at Watertown Arsenal, Watertown, Mass., in an article "X-ray Tests Applied to the Problems of the Steel Foundries," presents the following abstract:

> "X-ray tests with collateral analyses indicate that defects in steel castings fall into a relatively few classes traceable to definite and simple causes, most or all of which are removable. When defects are detected by X-ray examination and corrected by changing casting technique, they tend to stay corrected. It is possible by this method to eliminate from 75 to 90 per cent. of the major defects to steel castings.
>
> "Metal sections up to 3 inches in thickness may be examined. Where the value of the product warrants it, x-Rays may be used to test each individual casting. In other cases casting technique may be developed that will produce sound castings."

With its use hidden cracks in metal structures, and uneven distribution of components in an alloy are readily detected.

During the war the manufacture of explosives found great use for this great penetrating force. The correct filling of shells and liquid grenades, the interior study of detonators, igniters, etc., the checking of packing box contents, were made possible through its agency.

The study of wood structure as exemplified in airplane propeller examination, the study of optical glass, of hidden metal structures, were a few other war-time applications of the x-Ray.



x-Ray study of a Seahorse

Among other miscellaneous uses I can but briefly refer to such as the examination of golf balls to ascertain symmetry of core, of oysters for pearls, of metal mill particles in ground drugs, in the sorting of antiquated from fresh hen's eggs and many other similar uses.

Then one should mention the ingenious use made of the x-Ray by footwear dealers who permit customers to convince themselves by visual evidence that it is a feat to fit feet.

The archeologist or official grave robber finds it very handy where a coffin or a sarchophagus with its quiet content need not be disturbed, and yet have its secrets revealed.

Old masters by way of paintings can also be authenticated in this wise, modern paints and sizings showing great difference in opacity over those of the ancients.

THE DANGERS OF THE x-RAY

In past years the newspapers have recorded the deaths of a number of pioneer roentgenologists who were martyrs to x-Ray science, through having received the so-called x-Ray burns which resulted fatally.

Diaphanous Daffodils

These x-Ray burns had been inflicted years ago before science had determined the danger of unduly exposing the body to the rays without due precaution as regards protective devices. In other words, these pioneers in their intensive experimental work had unknowingly harmed themselves, some of the serious effects not being noticed for some years following exposure to the rays.

Fortunately, that day has passed, for modern equipment and modern methods have every provision for the protection of both operator and patient against the harmful or secondary rays, so that in the present day x-Ray burns can occur only through gross negligence or ignorance. Consequently, when we submit ourselves for x-Ray examination to a competent roentgenologist, we need feel no

fear of harm from the comparatively small amount of primary rays required in the production of a radiograph, or in the usual fluoroscopic examination.

In other words, x-Ray treatment has been in this day made "Safe for Democracy"—and for other denominations, too. Except—if we believe one of the most recent sensations in science. According to *Science Service,* x-Ray treatments of certain kinds, particularly of

"'Tis a feat to fit feet"—to suit the x-Ray

the "deep therapy" type, may be laying a terrible toll on the descendants of patients now receiving them. Defects and malformations *may* be visited upon their children far beyond the scriptural third and fourth generations; if man reacts to them as flies and rats do.

THE x-RAY AND HEREDITY

Yet the same kind of x-Ray treatments can speed up a hundred-fold the rate of the controlled evolutionary processes used by breeders to produce improved kinds of animals and plants.

This sensational paradox of science may be looked to for hitherto little suspected perils in the field of medicine and for revolutionary effects in agriculture, if the findings made by Prof. H. J. Muller,* of the University of Texas, on tiny fruit flies, the kind that buzz around grapes and peaches, hold true for other living things. These flies were chosen because of their promptness in attaining to maturity. Man takes twenty-one years, the fruit fly twenty-one days.

It has been proved in his experiments that in the germ-cells of the flies, x-Rays affect the little particles responsible for heredity (chromophores or gene aggregations) in much the same way as a cannon ball fired at a pile of pills would affect the pills. The hereditary particles become permanently transformed in all sorts of unexpected ways and the sudden changes known as "mutations" are produced in them.

Not all of them mutate at once, Prof. Muller explains, but here one, there another, they change in quite a random fashion. Sometimes also they are dislodged into new arrangements. Since these hereditary particles, which are known as "genes," and contained in the cell chromosomes, are handed down from parent to offspring, and determine the characteristics of the next and later generations, all kinds of new traits are likely to arise among a group of offspring or grand-offspring from parents that were treated with x-Rays. These new traits are permanent, as they are inherited by succeeding generations.

x-RAY SPEEDS UP EVOLUTION

It has long been known that such mutations occasionally happen without x-Ray treatment, and so give a chance for the breeder to improve his stock, by breeding from animals that have desirable mutations. In the same way in nature, the "survival of the fittest" mutations is thought to have brought about evolution. But the mutations that happen without x-Ray treatment are exceedingly rare and it has never previously been found possible to make them occur oftener. That is why animal and plant improvement has been so slow, and why it has been necessary to raise countless thousands of ordinary individuals for each advantageous mutation that has turned up.

*Dr. Muller's paper was judged to be the most notable presentation made at the meeting and won the $1000 award.

x-RAY: THE BURBANK BEYOND THE SPECTRUM

Now, if mutations can be produced at will, all this will be changed, and the production of new plant and animal varieties will go as far forward in ten years as it formerly did in a century.

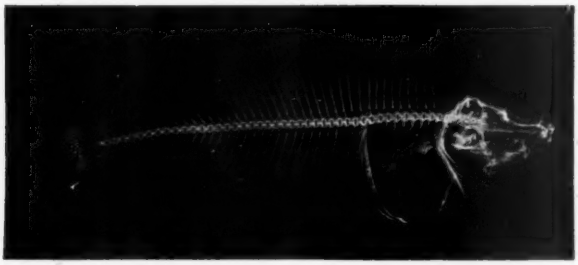
But mutations, whether produced by nature or by x-Rays, are bad oftener than they are good. The plant or animal breeder simply

The first Radiograph ever transmitted by telephone wire

throws away a hundred bad new varieties and keeps one good one. It is here that Dr. Muller sounds his warning as regards human beings. We do not make a habit of throwing away undesirable babies, and anything that might tend to produce a crop of unfortunate human freaks or cripples should be used on human beings with

extreme caution. *This does not mean,* he emphasizes, *that all x-Ray examinations or treatments are dangerous, but only those that expose the reproductive organs to prolonged or intense doses of the rays.*

In particular, x-Ray treatments applied for the purpose of deliberately producing temporary sterility are frowned upon. Five years ago, at the London meeting of the Birth Control Congress, Dr. C. C. Little, then of the Department of Genetics of the Carnegie Institution of Washington and now president of the University of Michigan, characterized the practice as "little short of a calamity."



The inedible framework of a fish as the x-Ray depicts it

At that time Dr. Little described experiments of his own on rats which had been subjected to this treatment. Young born to them subsequently appeared to be normal, but the third and following generations were marred by the frequent occurrence of repulsive physical defects and monstrosities.

Important as the possible human and practical consequences of his study may be, Dr. Muller states that the work so far constitutes only a beginning of the possibilities that lie along this line.

THE x-RAY IN THE REALM OF PHYSICS

Through the agency of the x-Ray, especially in connection with the spectroscope, physicists have been able to study the internal structure of the atom. It was through its agency, too, that Becquerel made the original investigations that spurred the Curies on to their discovery of radium and its contained forces.

Since the advent of x-Ray crystallography, too, has undergone a vast development. Indeed, the revelations of this ray and its kindred, in the realm of physics, is a subject too ramified for us to do else than mention it.

I want to conclude this rather disorganized address with a few quotations from addresses made at the recent meeting of the American Association for the Advancement of Science. This meeting gathered, queerly enough, yet possibly not without malice aforethought, in the hot-bed of sciosophy—the habitat of hokum, namely Tennessee. These abstracts show the significant part which the x-Ray —this very modern tool of scientific research—plays in the new order of things. The quotations are again from *Science Service:*

NASHVILLE, TENN., DEC. 29.—X-Rays are playing a highly important part in the discussions of the biologists gathered here this week for the annual meetings of the American Association for the Advancement of Science and its affiliated societies. Within recent months many workers in various parts of the field have discovered this well-known type of radiation to have literally miraculous powers to change the course of events in the development of living organisms, and to leave so deep an impress on their substance that their descendants, even to the last generation, will show the effect of their ancestors' experience.

Prof. Winterton C. Curtis and Raymond A. Ritter, of the Zoology Department at the University of Missouri, told of their researches on the effects of x-Rays on the development of growing tissue. They experimented on a small marine animal related to the jellyfishes, which reproduces itself by constantly budding off new individuals very much as a tree produces branches. After exposure to the x-Rays for ninety minutes the animals lost the power of producing new individuals, although the original parent portion remained alive.

THE CONTRARINESS OF x-RAYS

Prof. Robert T. Hance, of the University of Pittsburgh, told of some of the first results of x-Ray experiments on warm-blooded animals. The hair color of mice exposed to very light doses of the rays in his laboratory was radically changed. Normally "mouse-colored" mice of mixed ancestry went completely white after being rayed, while pure-bred mice

of the same color changed in the opposite direction and became darker.

Dr. H. J. Bagg of Memorial Hospital, New York City, and Dr. C. R. Halter, of Cornell University Medical College, working in collaboration, were also among the first to obtain positive results with warm-blooded animals. Their mice developed certain marked bodily defects, such as only one kidney instead of two, abnormal eyes, and legs in bad condition at birth. Such defects occur among mice bred under ordinary conditions, but not so often as among rayed animals.

Plants as well as animals respond to x-Ray treatment. Prof. T. H. Goodspeed of the University of California, has obtained results in the breeding of x-Rayed tobacco plants which are comparable with those of Prof. Muller on fruit-flies. The new varieties produced in this way have a stronger growth and produce more flowers than their cousins descended from un-rayed parents.

Prof. L. J. Stadler, of the University of Missouri, has conducted similar experiments with corn and barley. In these, as in all the other animals and plants on which the treatment has been tried, the hereditary units or genes have been knocked out of place and more or less violently rearranged, resulting in forms of life wholly new to the universe.

It is agreed on all sides at the gatherings of scientific men that the past year has been one of revolution in the study of heredity among living things, comparable with 1859, when Darwin published the Origin of Species, and 1900, the year of the rediscovery of Mendell's law.

While the biologists attending this meeting of the American Association for the Advancement of Science were listening to accounts of newly discovered ways in which x-Rays affect living tissue, the physicists heard about another new property of these rays. Dr. Fred Allison, of the Alabama Polytechnic Institute at Auburn, Alabama, told the American Physical Society how he had found that they change the effect of certain liquids and other substances on light.

Many liquids, such as a sugar solution, have the property of turning the plane of polarized light. Ordinary light consists of vibration in an indefinite number of directions, but when polarized, the vibration is confined to one particular plane. If a beam of such

light is passed through a sugar solution, it is still vibrating in one direction when it emerges, but in a different direction from that when it went in.

Dr. Allison has found that even liquids which do not ordinarily have this power gain it when exposed to x-Rays. When liquids, or glass, are placed in the field of a powerful magnet, they gain this property, as discovered many years ago by Faraday. When x-Rays are used in addition, says Dr. Allison, the rotatory powers of the liquids are increased, while in glass, it is made to rotate in the opposite direction.

Much might be said, especially in connection with the newer ray effects which have been recently announced. The "Penetrating Rays" of Mullikan, so powerful that they will wiggle their way through six feet of solid lead, whereas the most ambitious x-Rays are stopped dead by a half-inch of lead.

The Wynne rays—the new Coolidge rays—and others, are too abstruse to consider in this already extended presentation. The Death Rays—so-called because of their ability to suspend for all time our vital functions, merit one word in conclusion, and that word is—*Enough.*

ACKNOWLEDGMENTS

The Victor x-Ray Corporation of Chicago very courteously permitted the use of the cuts illustrating this article.

The following authorities were consulted in preparing the paper:

Applied x-Rays. *Clark:* McGraw, Hill Company, New York.

x-Rays. *Kaye:* Longmans, Green & Company, New York.

A Little Journey into the Realm of the x-Ray. Victor x-Ray Corporation, Chicago.

SCIENTIFIC AND TECHNICAL ABSTRACTS

THE EARLY HISTORY OF IRON AND STEEL. *The Locomotive,* Oct., 1927, p. 239—The first historical reference to iron or steel is, undoubtedly, that made in the fourth chapter of Genesis to Tubal Cain as the instructor of every artificer in brass and iron. Bearing in mind the recent improvements in the manufacture of iron and steel, it is interesting to consider what small progress was made in the intervening centuries since this member of the sixth generation in decent from Adam plied his trade.

Greeks and Romans practiced steel-treating. The Delhi Pillar is a metallurgical mystery. In India, the science of the metallurgy of iron must have attained a high degree of perfection, probably because the lack of copper caused a certain amount of specialization. At Delhi there still stands an iron pillar that has stood for 1600 years, seemingly rustless. This pillar is approximately 12½ inches in diameter at the top and 16¾ inches in diameter at the bottom, is 24 ft. high, and weighs nearly seven tons. The upper section, for a distance of four feet from the top, is elaborately carved and fluted. This memorial to the metallurgical skill of the third century A. D. has caused much speculation as to how it was manufactured without the heavy machine tools and steam hammers of today. Furthermore, its resistance of corrosion is very much of a mystery. Sir Robert Hadfield recently secured a sample of the pillar for analysis and to have microphotographs made. The analysis shows the following composition: Carbon, 0.08; silicon, 0.046; sulphur, 0.006; phosphorus, 0.114; manganese, nil; and nitrogen, 0.030 per cent.; total 0.276 per cent.; iron, 99.700 per cent.; total, 99.976 per cent.

A NEW NON-BURNABLE FUMIGANT. (*Scientific American,* Dec., 1927, p. 542.)—Moths and beetles that prey upon clothing, carpets and furniture are to be attacked with a very effective new fumigant devised by R. T. Cotton and R. C. Roarke of the United States Department of Agriculture. These investigators have found that a mixture of three parts by volume of ethylene dichloride and one part of carbon tetrachloride is very effective against pests of this

type. The mixture is cheap, non-inflammable, non-explosive, non-injurious to stored commodities, and not dangerous to human life. The toxicity of the mixture is approximately five times that of carbon tetrachloride alone.

"All experiments with this mixture indicate that the fumigant has excellent powers of penetration. Insects rolled up in thick rugs and buried in overstuffed furniture are readily killed. In a special test, flour beetles, Tribolium confusum, and rice weevils, Sitophilus oryza, were sealed up in cartons of cereal; specimens of the Indian meal moth, Plodia interpunctella, and the saw-tooth grain beetle Oryzaephilus surinamensis were buried in boxes of candy and other insects were buried in piles of clothing and rugs. A dosage of fourteen pounds of the mixture per 1000 cubic feet at 80 degrees Fahrenheit gave a perfect kill."

NEW RESISTANT GLASS (*Scientific American*, Jan., 1928, p. 84.)—A glass that withstands pressure, heat, and acids better than any yet known is being successfully produced in Germany. It was first used for the manufacture of glass tube water gauges and glass bars. The newest tubes produced by this method will sustain a cold-water pressure of 20, 45, 65, 80 and 100 atmospheres.

This glass is also used in weaving and silk-spinning mills to replace bobbins of wood, which frequently became splintered and rough and tore the threads of the material. The dye from colored threads could not be entirely removed from the wooden bobbins and impurities often resulted when colors were changed. Original attempts to substitute glass bars for the wooden bobbins were unsuccessful because the glass used would not withstand fluctuations of temperature. The new glass, however, will stand a sudden change from 160 degrees to 0 degrees, Centigrade, without damage.

NEW INSECT-KILLING CHEMICALS SAID LESS DANGEROUS THAN ARSENIC—Greater deadliness to insects and their kindred pests but less danger to human beings and warm-blooded animals, are the virtues claimed for two new types of spray chemicals by Dr. Simon Marcovitch of the Tennessee Agricultural Experiment Station, who spoke before the recent meeting of the American Association of Economic Entomologists.

The new insect poisons on which he conducted his research are sodium fluoride and sodium fluosilicate. He tried them on grasshoppers, mosquito "wigglers" and one or two other small creatures, and also on rabbits as substitutes for human subjects. He found that the insect life in general succumbed to smaller doses of the new compounds, but that to the rabbits they were only about one-ninth as poisonous as the standard arsenical spray materials now most widely used. The alleged poisonousness of arsenical residues on sprayed fruits and vegetables has been a subject of much debate of recent years; but Dr. Marcovitch is of the opinion that the new sprays make it possible to be on the safe side.—*Science Service.*

Enforcement of Caustic Poison Act Begun—The branch stations of the Food, Drug and Insecticide Administration of the United States Department of Agriculture, which are located in sixteen of the leading trade centers of the United States, have been instructed to make a survey in their respective territories of the products subject to the Federal Caustic Poison Act and to initiate such action as may be necessary to see that all such products are labeled in accordance with its provisions, according to officials charged with the enforcement of the act.

The enforcement of the act was begun, say the officials, immediately upon the passage on December 22, 1927, of the deficiency bill which first provided funds for its enforcement. The purpose of the act is to safeguard the distribution and sale of certain dangerous caustic or corrosive acids and alkalies in interstate and foreign commerce. It became a law on March 4, 1927, but no penalties were to be imposed until September 4, 1927, six months after its enactment. Manufacturers of the products subject to the act have now had over nine months in which to familiarize themselves with the requirements of the act and to label their preparations in accordance with its terms.

It provides in general that dangerous caustic or corrosive acids and alkalies when in a container suitable for household use shall bear a conspicuous and easily legible label containing the common name of the substance; the name and place of business of the manufacturer, packer, seller, or distributor; the word "Poison" to be in uncondensed, Gothic capital letters in twenty-four point size type, except when no other letters on the label are in type that large,

when the word "Poison" may be printed in type not smaller than the largest type used on any part of the label; the label shall also bear directions for treatment in case of accidental personal injury.

The act provides that shipments in interstate or foreign commerce which are misbranded under the act may be seized and that the persons responsible for the violation of the act may be prosecuted in the Federal courts. Upon conviction any person violating the act may be fined not more than $200 or imprisoned for not more than ninety days, or both. It is the opinion of the officials that few prosecutions will be necessary since it is expected that manufacturers of products subject to the act will label them in accordance with its provisions.

Rules and regulations for the enforcement of the act have been prepared and are now being printed. Copies of the act and regulations may be obtained upon application to the Food, Drug and Insecticide Administration, United States Department of Agriculture, Washington, D. C.

MEDICAL AND PHARMACEUTICAL NOTES

MISBRANDED COD LIVER PREPARATIONS—Action is under way to remove from the channels of interstate commerce adulterated, misbranded, deteriorated, or otherwise illegal extracts of cod liver, cod liver oil, and preparations falsely alleged to contain the vitamins of cod liver oil, according to a statement issued by officials of the Food, Drug and Insecticide Administration of the United States Department of Agriculture.

During 1927 the Department of Agriculture conducted an extensive survey of extracts of cod liver, of cod liver oil and of various products alleged to contain the vitamins of cod liver oil found in interstate commerce. A biological examination for the presence of vitamins A and D in these products showed that practically all of the extracts and concentrates examined were virtually devoid of vitamin A and that very few contained any material amount of vitamin D. Several of these articles have been used extensively in the manufacture of so-called cod liver oil compound tablets and other preparations.

The Federal Food and Drugs Act makes the manufacturer or distributor of medicinal products responsible for marketing them in harmony with its provisions. Manufacturers should assure themselves that the cod liver oil vitamins are present in therapeutically significant amounts. The Department of Agriculture will take action against products that are labeled or represented as containing the cod liver oil vitamins, unless such products contain in the recommended dosage cod liver oil vitamins in quantities equivalent to those present in the normally prescribed doses of cod liver oil.

Products represented as concentrates of cod liver oil should contain viatmins A and D in concentrations reasonably higher than those of a good grade of cod liver oil. Statements regarding the therapeutic effects of the preparations should be limited to those that can be fully substantiated by the consensus of present-day medical opinion. Investigations of this class of products will be continued for the purpose of removing from the market adulterated, misbranded, deteriorated, or otherwise illegal preparations.

THE BACTERIAL ACTION OF CHLORINE IN WATER. *Das Gas- und Wasserfach,* Nov. 19, 1927, p. 1133 (A. Romwalter)—The effectiveness of very small quantities of chlorine or hypochlorite ions in destroying bacteria in water supplies is a demonstrated fact for which there is no generally received explanation. Bunau-Varilla and Techoueyres have attributed it to ultra-violet radiation emitted by the reaction of the disinfectant with the bacteria. Direct proof of the existence of such radiation would seem to be best furnished by photography, and the experiments here described were on this basis; they lead the author to reject the ultra-violet hypothesis. As an alternative explanation he points out that the volume of the bacteria ordinarily present is much smaller even than that of the added chlorine, of which even less might suffice if much of it were not wasted by combination with inorganic matter in the water.

PRIES INTO SECRETS OF LONG-LIVED SEEDS—Lotus seeds, which have been credited with the ability to sprout after being kept out of the water for 300 years or more owe their resistance to fatal drying, as well as the reluctance to sprout even when they are placed

under favorable conditions when they are young, to their remarkably waterproof coats.

At the recent meeting of the Botanical Society of America Dr. Margaret F. Shaw of Vassar College, told of her research into the microchemistry of this resistant seed coat. It consists, she stated, of several distanct layers, each composed of cells reinforced with woody material. The main defense against the entry of water seems to lie in one of the outer cell-layers, each member of which is lined with suberin, which is the stuff cork is made of.

FOR AND AGAINST TUBERCULOSIS VACCINATION—The preventive treatment of tuberculosis by vaccination has begun to receive serious attention in this country.

Leading bacteriologists of the United States at a conference here discussed the possibilities and drawbacks of the protective treatment which has been tried on some 30,000 French children by Dr. Albert Calmette and his collaborators of the Pasteur Institute in Paris. The vaccine, which consists of an attenuated strain of tuberculosis bacilli so weakened that their virulence is lost though their immunizing qualities are retained, is known as B. C. G., the initials for bacilli Calmette Guerin, for the workers who first developed it. It has been administered with apparent success to new-born infants in the slums where tuberculosis in the family makes infection seem inevitable.

Prof. C. E. A. Winslow of the Yale School of Public Health, was of the opinion that the method should have a thorough trial of animal experimentation in this country.

"B. C. G. can be given to cattle," he reminded. "Let us give the treatment to animals so that we can see whether they are protected against subsequent exposure to the disease, or whether on the contrary the preventive measures really result in a delayed attack of tuberculosis.

"Our present attitude towards B. C. G. treatment for tuberculosis will not get us very far in fifty years," Dr. Winslow predicted. "Let us perform the experiments on cattle and then we should be able to tell in less than ten years whether the measures are really an effective prevention, or merely an added source of danger."

Dr. M. H. Soule, of the Hygienic Laboratory of the University

of Michigan, just returned from a visit to Calmette's clinic in Paris, expressed more enthusiasm.

"Children who have received the treatment are being helped," he declared. "They would be dying in thousands if they had not been given the treatment, and they are still falling victims to the disease in localities where it has not as yet been possible to apply the preventive doses of B. C. G.

"Dr. Calmette is thoroughly aware of the objections which have been made to his methods, but the evidence indicates that the treatment is a successful one despite the fact that bacteriologists are not in agreement on the subject. The work should be receiving wider support."

Dr. Soule is an expert on the variability of bacterial species and has been able to produce and control changes in the methods of growth and poisonous properties of many different families of bacteria. He states his belief that treatment with B. C. G. is theoretically sound.

Among those who sounded a note of warning, however, was Dr. S. A. Petroff, of the Trudeau Sanatorium, Trudeau, N. Y. Dr. Petroff has made a careful study of the weak but protecting bacteria of the French investigators using the original French strains of B. C. G. "We have been successful in getting B. C. G. back to full strength," Dr. Petoff stated. "When the proper nutritive media are used for this strain of bacteria, the enfeebled powers can be restored and the ability to cause tuberculosis completely won back." This was proven by inoculation of laboratory animals with the revivified bacteria. They took tuberculosis. "Hence the treatment is dangerous," the bacteriologist warned. "This organism must be considered as one potentially capable of causing the very disease it is desired to prevent."

Objection to the use of living bacteria on any grounds whatever was made by Dr. Ralph Mellon, of the Western Pennsylvania Hospital, Pittsburgh. "We do not yet know sufficient about B. C. G. to use it with confidence," he declared. "We know that when a person is exposed to tuberculosis, he may display no symptoms of the disease for ten years, but it appears in the end. The Calmette organisms should be studied over a long period of time, so that we may be sure that the organisms are really a protection against the disease and not an inoculation of the malady which remains to show itself many years later.—*Science Service.*

FRENCH VACCINATE WITH PILLS FOR CHOLERA AND TYPHOID —Pills of dead bacilli are taken before breakfast for three days in the simple method of immunization against typhoid, dysentery, and cholera now being used by people in large sections of Europe and Asia. The pills are preceded by doses of ox bile in the typhoid and cholera vaccination.

This means of immunization which grew out of animal experiments made at the Pasteur Institute by Prof. A. Besredka is becoming increasingly popular, according to Dr. Harry Plotz, his American assistant. It is being used now extensively in France, Russia, Italy, Spain and India, Dr. Plotz stated in an interview with a Science Service correspondent.

"Vaccination by the mouth is much simpler and easier for the patient," he said. "There are no disagreeable after-effects such as often follow vaccination under the skin and which, in the case of dysentery, proved so disastrous that the subcutaneous method was abandoned.

"It is also more rapid in its immunizing power. We have proved experimentally that immunization takes place a day or two after the last dose of vaccine is given."

Moreover, the new method is quite as effective as the old, he stated. Statistics show that in various typhoid and cholera epidemics where both methods were used, vaccination by the mouth was equally effective, and, in some cases, more so. Just recently Lt. Col. A. J. H. Russell in a report to the medical section of the League of Nations showed that he had found vaccination by the mouth and vaccination under the skin to be of equal effectiveness for cholera. He drew these conclusions after extensive vaccinations in towns in India, using both methods. Col. Russell is Director of Public Health, Madras, India. Vaccine by the mouth was given 4982 persons. Of these eighteen contracted the disease with four deaths resulting. In other words the percentage attacked was 0.36 with the deaths 22.2 per cent. of those. Among 11,004 unvaccinated controls, 222 contracted cholera and 93 died making the percentage 2.02 attacked of which 41.9 per cent. died. Vaccine under the skin was given 8485 persons of whom thirty-one contracted the disease, two dying. The percentage attacked was then 0.37 and the mortality 6.5. Of 29,254 unvaccinated controls in this experiment 489 contracted the disease, 184 dying. The percentage attacked was 1.67 and the percentage of mortality 37.6.

Professor Besredka's theory which led him to experiment with oral vaccination is a very simple one, Dr. Plotz explained. It is simply that it is logical to vaccinate the organ that is infected during the course of the disease. In the case of dysentery, typhoid and cholera, the germ enters by way of the mouth and produces the disease in the small intestine. Then why not vaccinate by the mouth, he queried, and emulate mother nature as much as possible? This is a far more direct way for the vaccine to reach the intestine than through the skin.

But to immunize against typhoid and cholera Prof. Besredka found that it is necessary to administer ox bile first. Bile prepares the mucous membrane of the intestinal wall to receive the dead bacteria which are given by the mouth. It removes the mucous and prepares for the absorption of the vaccine which might otherwise slip through the intestinal tract. In the case of dysentery, however, the bacteria in the vaccine are capable of performing this function themselves.

American workers in this field regard Dr. Besredka's figures as interesting and encouraging but are of the opinion that they cannot be accepted at their face value alone. Interpretation of such fundamental experiments, they maintain, is not entirely acceptable without further confirmation.—*Science Service.*

Biologist Calls Coffee Beneficial Beverage—Devotees of the coffee cup will welcome the glad tidings, announced by Prof. Ralph H. Cheney of the Biology Department of New York University, that coffee is not only harmless but beneficial.

"Evidence derived from my study of the effect of coffee on animals and man," Prof. Cheney declared recently, "indicates that the properly prepared beverage is highly advantageous with respect to over 90 per cent. of normal individuals. Judging from the effect of aqueous solutions of caffeine or of the coffee beverage taken through the stomach in 1.5 grain quantities such as exist in the average coffee cup, the reasonable use of coffee is a great blessing to man. To be sure, caffeine is a drug and its use can be abused but acute injury, as far as the caffeine content is concerned, would necessitate the consumption of over 150 cups which is, of course, ridiculous.

"Psychological responses of amiability and a sense of well-being and good cheer are undeniable accompaniments of the coffee beverage and the physiological effects are also non-injurious and gratifying. Temporary relief from hunger and fatigue is a general result and light headaches, due to other than gastric disturbances, are commonly alleviated. Coffee serves as a mild stimulant of the heart, brain and muscles, thereby accomplishing greater power and co-ordination in mental and physical endeavors.

"The outstanding fact to be heralded in favor of coffee is the absence of any after-effect or subnormal, recuperation period. It does not seem to be habit-forming since satisfactory stimulation does not require continually enlarged quantities. No other beverage produces equal stimulation without deleterious after-effects. On this basis, it is safe to say that coffee, prepared by subjecting the ground bean to water just below the boiling point for five minutes or even somewhat longer in most household percolators, is not injurious to adults in normal health who show no acute idiosyncrasy regarding caffeine or other substances in the beverage."

Coffee is an impressive example of a plant, Prof. Cheney pointed out, whose economic importance has been raised to great heights by its successful planting in a locality entirely foreign to its natural distribution since it is indigenous to Africa and Asia and is raised principally in Brazil and Colombia. The United States is the largest consumer, coffee imports being exceeded only by sugar and raw silk.—*Science Service.*

NEWS ITEMS AND PERSONAL NOTES

Dr. Wilmer Krusen Assumes Presidential Duties—Dr. Wilmer Krusen, former Director of the Department of Health in the Philadelphia city government and recently elected president of the Philadelphia College of Pharmacy and Science, formally assumed his new duties as president of the Mother School of Pharmacy in the United States on Tuesday morning, January 3d.

Dr. Krusen relinquished his official duties as Director of Health on Monday, January 2d, when the new Mayor of the City of Philadelphia was inaugurated. During his four years as head of the

Health Department, the City of Philadelphia made great improvements in the city hospitals under his charge, the major feature being the completion of the new Philadelphia General Hospital, one of the largest and most complete institutions of its kind in America. Under a previous City Administration, Dr. Krusen also served as Director of the combined Department of Public Health and Charities.

In assuming direct administrative control of the college, Dr. Krusen was given a reception in the president's room of the new College Building just completed at Forty-third and Kingsessing Avenue, in West Philadelphia, very close to the University of Pennsylvania. Among those who took part in the reception were the trustees and the major faculty of the college.

From this time on the new president, who is widely known in medical and pharmaceutical circles, not only in the United States but also abroad, will devote all of his time to the college work.

Arrangements are now being made by the college authorities for the forthcoming Founders' Day exercises in the new building on Thursday, February 23d, when alumni from all parts of the country will be in attendance. At that time, one or two days will be set aside for a public reception and inspection of the building and equipment, and it is expected that more than 25,000 persons will participate. One of the interesting features of the equipment of the new college will be a complete up-to-date drugstore.

PROFESSOR LLAMES, UNIV. OF THE PHILIPPINES, DOING POST-GRADUATE WORK—Listed among the post-graduate students at the college is Antonio Llames, president of the Board of Trustees and professor of the University of the Philippines. Mr. Llames holds the degrees of A. B. and Ph. C., and is studying for one of the higher degrees. He was sent here for post-graduate work by the Bureau of Insular Affairs at Washington.

SYNTHETIC MENTHOL—This new product of the laboratories of the well-known firm of Schimmel & Company, which has been received with such great favor abroad, is now available through Fritzsche Brothers, Inc., New York. Like the natural, it is laevorotatory, with a melting point of 35 degrees and in appearance and odor is very similar to natural menthol crystals from peppermint oil.

The physical properties lie between the scientifically well-known inactive (racemic) menthol from thymol or piperitone and the natural d-menthol (melting point 43-44 degrees).

After thorough examination by Professor Gros at the Pharmacological Institute of Leipzig University on behalf of Schimmel & Company, it was found to be not only slightly more active physiologically but actually less toxic than natural menthol. Samples and prices are available upon request.

ADVISORY BOARD VISITS LABORATORY—The Advisory Board of the Antivenin Institute of America, a division of the Mulford Biological Laboratories, Glenolden, Pa., met in Philadelphia recently.

Dr. Howard A. Kelly, of Baltimore, Hon. Curator of Reptiles at University of Michigan, Colonel J. F. Siler, ex-president of the American Society of Tropical Medicine, Dr. Herbert C. Clark, of New York, members of the board; Dr. Afranio de Amaral, director of the Institute; Mr. Raymond L. Ditmars, the well-known reptile expert of the New York Zoological Gardens; Mr. Milton Campbell, president, and other members of the Mulford staff, were present.

They discussed the past and present work of the Institute, and of particular interest was the establishment of the Serpentarium at Tela, Honduras, and the good work done in that country in the collection and field study of the snake problem as it affects agriculture, and the interest of natives and foreigners in the advisability of administering antivenin treatment in snake-bite cases.

A visit was later paid to the laboratories, where the work of Dr. Amaral was reviewed and enthusiastically commended. The support of all was pledged to continue the work of the Institute in collecting and disseminating information, and in research work on snake venoms and antivenins.

Dr. Amaral, responding to the call of duty from his native land, returns to the laboratories at Butantan, Sao Paulo, but will retain his connection with the Institute in the capacity of consulting director. Qualified scientists, thoroughly trained in his methods and technic, will continue Amaral's work in the production of antivenin, so that the high standard already set will be maintained in this product "for the conservation of life."

HOLD-UP IN PROFESSOR RAUBENHEIMER'S PHARMACY—In a hold-up in his pharmacy in Brooklyn Prof. Otto Raubenheimer forced the gunman to the wall, but unfortunately received several scalp wounds. However, we are glad to state that no fracture of the skull resulted and that the professor is again "on the job."

DR. FRANCIS E. STEWART WEDS—Announcement is made of the marriage of Dr. Francis E. Stewart, The Delmar-Morris Apartments, Germantown, Philadelphia (P. C. P., Class of 1876), and Mrs. Susan Palmer Linnel, of Englewood, New Jersey, at New York City, December 26, 1927.

COLLEGE NEWS ITEMS—Professor Ivor Griffith, during December, delivered addresses before the Exchange Club of Philadelphia, the Westminster Club of West Philadelphia and the Boulevard Men's Club, one of the largest organizations of its kind in the city.

COLLEGE MAKES NOTABLE EXPERIMENT—The Philadelphia College of Pharmacy and Science has just completed a remarkable series of scientific demonstrations of the earth's movement, held in the old college building just prior to removal to the new buildings in West Philadelphia.

This experiment, which is rarely performed because of the physical difficulties in fixing upon a site free from vibration and a tower of sufficient height, was conducted for the purpose of enabling students in science to witness this visual demonstration of the earth's movement during a fixed period of time.

The college had available a shaft eighty feet in height in the center of its large building, and this unusual condition made possible the installation of a seventy-five-foot pendulum having a maximum swing across a diameter of approximately seven feet. By the aid of a chart, laid out in degrees, placed on the floor with its center directly under the pointer on the motionless pendulum bob, the path of the pendulum when set in motion was readily traced and the degree of variation plainly indicated.

During the course of a lecture given recently at the college by Dr. George Rosengarten, associate professor of physics, this test

aroused so much interest and comment that the college at once took steps to arrange for similar demonstrations which were held for the benefit of students in Philadelphia and vicinity.

DEDICATION OF NEW BUILDING OF PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE, FEBRUARY 23D—On Thursday, February 23d, the new and handsome building of the Philadelphia College of Pharmacy and Science will be dedicated at 4 P. M.

The formal dedicatory exercises will be presided over by the president, Dr. Wilmer Krusen. Reverend Dr. J. A. MacCallum will offer the invocation. The address will be made by the Hon. Hampton L. Carson, president of the Pennsylvania Historical Society.

The exercises will conclude with the formal transfer of the keys from Architect Norman Hulme to Mr. Otto W. Osterlund, Chairman of the Finance Committee and of the Building Committee, who in turn will transfer them to President Wilmer Krusen who will finally hand them to Dean Charles H. LaWall and Dean Julius W. Sturmer.

At 8 P. M. there will be opening exercises of an informal nature which will be presided over by Mr. Joseph W. England. Messages of greeting will be received from many organizations.

There will be music provided for both of these occasions and at the close of each the building will be thrown open for complete inspection by the visiting alumni and guests.

BOOK REVIEWS

MATERIA MEDICA AND PHARMACOLOGY. David M. R. Culbreth. 7th edition. 1046 pages; 497 illustrations. Lea & Febiger, Philadelphia.

The word "pharmacology" is used in two distinct senses; by some it is employed to signify all forms of knowledge concerning drugs, including their botany, chemistry, toxicology and therapeutic uses; others limit its meaning to the study of the effects on the animal economy, or what is more definitively called pharmacodynamics. Dr. Culbreth apparently prefers the first meaning which makes the

title of this book unfortunately tautological; it is as though one should write a treatise on "Vision and Sight." If the more restricted sense is given the word pharmacology the title would still be an unhappy one, for the weakest sections of the work are those which deal with pharmacodynamics.

The confusing title is especially unfortunate because in those divisions of Materia Medica to which the greater part of space is devoted—namely botany and pharmacognosy—the book is one of the most valuable treatises with which we are acquainted. It covers in a condensed, but comprehensive, manner all the essential facts concerning the botanical characteristics of the plants, the general appearance of the whole drug and the most important microscopic features of the powdered substance, the commercial adulterants, important constituents and pharmaceutical preparations. Short paragraphs are also devoted to the physiological actions and medicinal uses; these might well have been omitted as they do not reflect modern ideas or practises.

Among the many commendable features of the book, especial attention may be called to the illustrations, of which there are nearly 500. So often pictures are added to books merely as adornments that one has a feeling of pleasure in finding a work in which the "illustrations" actually illustrate the text. The Chinese have a saying that "One picture is worth ten thousand words"; most of the pictures in Dr. Culbreth's book convey an idea that could not have been made as clear with many pages of words.

This book is a treatise on the whole field of materia medica, covering not only the vegetable and animal drugs but also the inorganic and synthetic chemicals used as medicines. It is a work whose popularity is demonstrated by the fact that it has passed through six previous editions, and one which every pharmacist who holds his occupation as something more than that of a tradesman should have in his library.

H. C. Wood, Jr.